CORTLAND STREET DRAWBRIDGE

1440 WEST CORTLAND STREET

CERMAK ROAD BRIDGE

501 WEST CERMAK ROAD

PRELIMINARY STAFF SUMMARY OF INFORMATION
SUBMITTED TO THE COMMISSION ON CHICAGO LANDMARKS · OCTOBER, 1989

CORTLAND STREET DRAWBRIDGE (originally called Clybourn Place Bridge)
1440 West Cortland Street

Type: Double leaf trunnion bascule bridge

Date of Completion: May 24, 1902

CERMAK ROAD BRIDGE
501 West Cermak Road

Type: Scherzer rolling lift bridge

Date of Completion: November 1, 1906

Civil engineering is an often overlooked field of achievement in Chicago's history. As defined by the dictionary, civil engineering is that branch of engineering concerned primarily with public works such as land surveying, sewage disposal, water supply, and the building of highways and bridges. The latter have played a significant role in Chicago. In summarizing the nationwide impact of bridges, author Daniel L. Schodek, in *Landmarks in American Civil Engineering*, makes a statement especially applicable to Chicago's experience:

> Bridges are commonplace but richly symbolic elements in our landscape. In a unique way, they serve as an emerging society's statements of aspiration and intent. In no other structure do so many aspects of engineering, technology, civil design, economics, and social organization come together to produce a single form. The history of American bridge building then, epitomizes the development of the nation as a whole; it also encapsulates the remarkable evolution of bridge-building theory from a long-established but empirically based design approach to a highly developed engineering art.

Ever since 1673, when Louis Jolliet and Pere Jacques Marquette identified the Chicago River as an ideal transportation conduit, a resolution has been sought to the conflicting demands of navigational traffic on the river and pedestrian and vehicular traffic across the river. The ultimate solution was the movable bridge whose technological advancement was one of the most important civil engineering accomplishments to come out of the nineteenth century.

Today the City of Chicago has fifty-two movable bridges, more than any other city in the world. Forty-three of these are currently operable, and all but one can become functional within a matter of months if the U.S. Coast Guard or the Department of Defense

deem it necessary. Two in particular illustrate important developments in the science of designing the movable bridge: the Cortland Street Drawbridge (1902), the first trunnion bascule bridge built in the United States, and the Cermak Road Bridge (1906), the only remaining example of a Scherzer rolling lift mechanism owned and operated by the City and the oldest highway bridge of this type in the metropolitan area. Unquestionably, as a transportation mode, the bridge parallels the railroad as an instrumental factor in propelling Chicago to the forefront as a center of commerce and industry.

Capsule History of Early Chicago Bridges

Chicago's first bridge was a primitive affair. Built in 1831, it was privately financed by an enterprising tavern owner and storekeeper on the west bank of the North Branch of the Chicago River who wished to accommodate the east bank patrons of his reputedly bawdy saloon. A year later, a rustic affair of logs was constructed across the South Branch with labor provided by the soldiers at Fort Dearborn. The total cost was $486.20, $200 of which was contributed by the Potawatomi Indians. By the time Chicago was incorporated as a city in 1837, getting to and fro across the river was officially conducted by ferryboat. The critical need filled by this conveyance is exemplified by the fact that to this day the only persons permanently exempt from local jury duty are "constant ferryboatmen."

The city's first movable bridge, the Dearborn Street Bridge built in 1834, proved to be more of a hindrance than a help. The ten-foot-wide wooden drawbridge, operated by chains and allowing a sixty-foot passage for cargo vessels, was unreliable as it was constantly getting stuck, once for a record two days. In 1839 the City's Common Council ordered it removed, and the story is told that irate citizens armed with axes took it upon themselves to destroy the bridge that very night less the fickle Council members change their minds the next day. 1840 brought the construction of another movable bridge, a pontoon swing at Clark Street. This early bridge type had a movable span that rested on a pontoon in the water and then swung to one side to provide passage. This first publicly financed public works project of note was not universally supported due to conflicting economic interests between the North and South sides of the city as the *Chicago Times* reported:

> Every night there came up out of the south a great fleet of wagons or prairie schooners as they were called that parked on the government reservation on the south bank of the river. A fleet often numbered 500 wagons and came laden with wheat and corn and all sorts of produce. All the warehouses were, in that day, built on the North bank of the river. The business interests of the South side opposed the building of bridges as they did not wish these prairie schooners to reach the warehouses on the North side. It was their desire to keep them on the South side and compel them to trade there.

Despite this controversy, by 1848 variations on the pontoon bridge had been built at Wells, Randolph, and Kinzie streets. Unfortunately, in March of 1849, horrific winter floods swept the city, causing considerable damage to wharves and anchored ships and virtually destroying all of Chicago's bridges.

Recovering from this devastation and on into the next several decades, bridge builders incrementally introduced upgraded designs. In 1856, the first iron swing bridge was built at Rush Street for a total cost of $48,000. This design was supported by a pier in the middle of the river and rotated in a horizontal plane on a turntable. When fully opened, the bridge paralleled the center line of the river and hence allowed vessels to pass on each side of the pier. Just seven years later, this bridge collapsed when a herd of cattle, spooked by the whistle from a passing boat, stampeded to one end of the bridge which then broke down under all the weight. Although swing bridges continued to be built, this type did have one major drawback. The center pier limited the width of the channel leaving insufficient space for the larger commercial crafts, by now steam operated and wide of beam, to navigate around it. Vessels were known to ram the pier, damaging not only themselves but also the bridge. While the mariners were demanding an unobstructed waterway, land traffic was calling at the same time for wider bridges that could be opened and closed quickly.

During the 1890s, two other movable bridge types were tested as solutions to the dilemma of the obstructionist center pier of the swing bridge. The first was the Harmon jack-knife, first built at Weed Street in 1891. Each leaf of the bridge was hinged at two places and, in the raised position, the hinged leaves folded against the supporting towers on each bank. Thomas Pihlfeldt, for many years the city's Engineer of Bridges, described its erratic apparatus as a "combination folding bed and mousetrap." Eventually, the jack-knife design was abandoned as the many joints required for its operation necessitated frequent and costly maintenance. A second attempt was made with the Waddell lift bridge, first constructed at South Halsted Street in 1894. Here a single steel span was vertically raised between two towers using counter balances at the end of cables like an elevator. This too was soon discarded for not only was it expensive to build, maintain, and operate but its towering and ungainly superstructure afforded an unattractive and unsightly appearance. Once again, bridge builders went back to the drawing board. Writing in the *Chicago Tribune* in July, 1972, Charles Leroux succinctly summarized their particular problem:

> The people who design movable bridges face a confounding set of challenges. They must create a thing that is neither fish nor fowl. It doesn't stand rock-still, like a building, but then again, it doesn't move all in one piece like a boat. It must leap across a sizeable distance without touching down in between, and yet it must bear hugh loads.
>
> Designers are asked to shape a prima ballerina who is also a weightlifter, and they give themselves an added, supreme problem. They want this unlikely creature to be beautiful.

The solution was finally found to be the bascule bridge. In Chicago, this type was pioneered and perfected to its most modern and technically sophisticated conclusion.

The word "bascule" comes from the French and means rocker, see-saw, or teeter-totter. The operation of the bascule bridge is roughly analogous to that piece of equipment found in most children's playgrounds, that is, a device depending on weights at both ends of a beam supported on a fulcrum. The modern bascule bridge, which may have one or two leaves, is constructed of steel and machine-driven, but its historical antecedents go as far back as the wooden drawbridges that crossed the protective moats encircling medieval castles. In the late nineteenth century, the most promising innovation was the Scherzer rolling lift bascule bridge.

William Scherzer and the Rolling Lift Bridge

The inventor of the rolling lift bridge, William Scherzer was born on January 27, 1858 in Peru, LaSalle County, Illinois. He graduated from the Polytechnicum in Zurich in 1880 with a degree in civil engineering. For three years he worked for the Mathiessen V. Hegler Zinc Company and then from 1883 to 1885 he was employed by the Pittsburgh, Fort Wayne and Chicago Railway Company. For the following eight years until his untimely death on July 20, 1893 at the early age of 37, he worked for both the Keystone Bridge Company and the Carnegie Steel Company. His innovative rolling lift design was patented on December 26, 1893 and commercially developed by his brother after William's death. Albert H. Scherzer, although a practicing lawyer, became president and chief engineer of the Scherzer Rolling Lift Bridge Company with offices in the Monadnock Block. The entry for Albert H. Scherzer in the 1911 *Book of Chicagoans* notes that he "contributed to scientific and technical press on bridge engineering, ship canals and improvement of rivers, harbors and transportation facilities." Both William and Albert Scherzer made important contributions to Chicago's scientific and engineering community, and Scherzer rolling lift bridges were built all across the United States and as far away as Canada, Russia, and Argentina.

Scherzer developed his rolling lift bridge for Chicago's Metropolitan West Side Elevated Railroad, first built in Chicago in 1894 near Van Buren Street. As explained in *Chicago Public Works: A History-Chicago* (1973), it was "a bridge constructed with two movable leaves that came together at the center of the stream. Each leaf rolled up and down, like a huge rocking chair with cogs on its runners matching cogged rails on its abutment at the shore end." Constructed for the City of Chicago was a bridge at Van Buren Street in 1895 and one at North Halsted Street in 1897. The Cermak Road Bridge, originally constructed by the Sanitary District of Chicago who highly favored this design, was completed on November 1, 1906. In *Chicago Bridges*, published in 1984 by Chicago's Department of Public Works, consultant Joan Draper notes that: "This bridge is unattractive, but presents a powerful image." While the Cermak Road Bridge is architecturally insignificant, it does have value in engineering history as the only remaining one of its kind owned and operated by the City of Chicago.

The Trunnion Bascule Bridge

Despite its initial popularity, the Scherzer rolling lift bridge was not without flaws. Its rolling mechanism necessitated massive foundations that not only lessened the width of the river channel but also proved ill-suited to some river banks. Some of the early ones proved unstable, and their lack of aesthetic appeal was an additional drawback. With these factors in mind and faced with the need to replace a number of the city's deteriorating bridges, Chicago's Division of Bridges and Viaducts of the Department of Public Works in 1899 put together a task force to conduct a thorough survey of all state-of-the-art movable bridge designs in the United States and Europe to determine which type was most compatible with conditions along the Chicago River. The team was led by City Engineer John Ernst Ericson. Born in Stockholm on October 21, 1858 and graduated from the Royal Polytechnic Institute in that same city, Ericson came to the United States in 1881. His varied background included construction and operation of water and harbor works, tunnels, and railroads as well as bridges. He was appointed City Engineer on July 6, 1897.

The study recommended a type identified as a trunnion bascule bridge. City engineers proposed newly developed and original designs based on its principles for use in Chicago. The immediate prototype for this new Chicago type bascule bridge was the central span of London's Tower Bridge, completed in 1894. In counterdistinction to the principle of the rolling lift bascule design, of rolling back counter-balanced leaves on the rims of huge wheels, the trunnion bascule design involves revolving the leaves around fixed trunnions, or shafts. In *The Movable Bridges of Chicago: A Brief History*, compiled by the Department of Public Work's Bureau of Engineering in 1983, the following more fully explains how the trunnion bascule bridge works:

> In the trunnion bascule type, the bridge leaves are supported at the shore end on a trunnion, or shaft. In opening, the bridge rotates about this shaft and raises its leaves to a nearly vertical position, giving an absolutely clear, open river passage for water craft.
>
> When the bridge is open or opening, the trunnion supports the entire dead weight of the structure. The river arm, extending from the trunnions over the water is, of course, a greater length than that part of the bridge extending to the rear of the trunnions. This makes necessary the use of a counterweight at the rear of the bridge in order that the entire mass may be balanced about the trunnions. Such a bridge is raised, or lowered, by the operation of a rack attached to the rear end of each truss. The pinions which engage the racks are operated by an electric motor and machinery controlled by an operator located in a small house near the river bank.

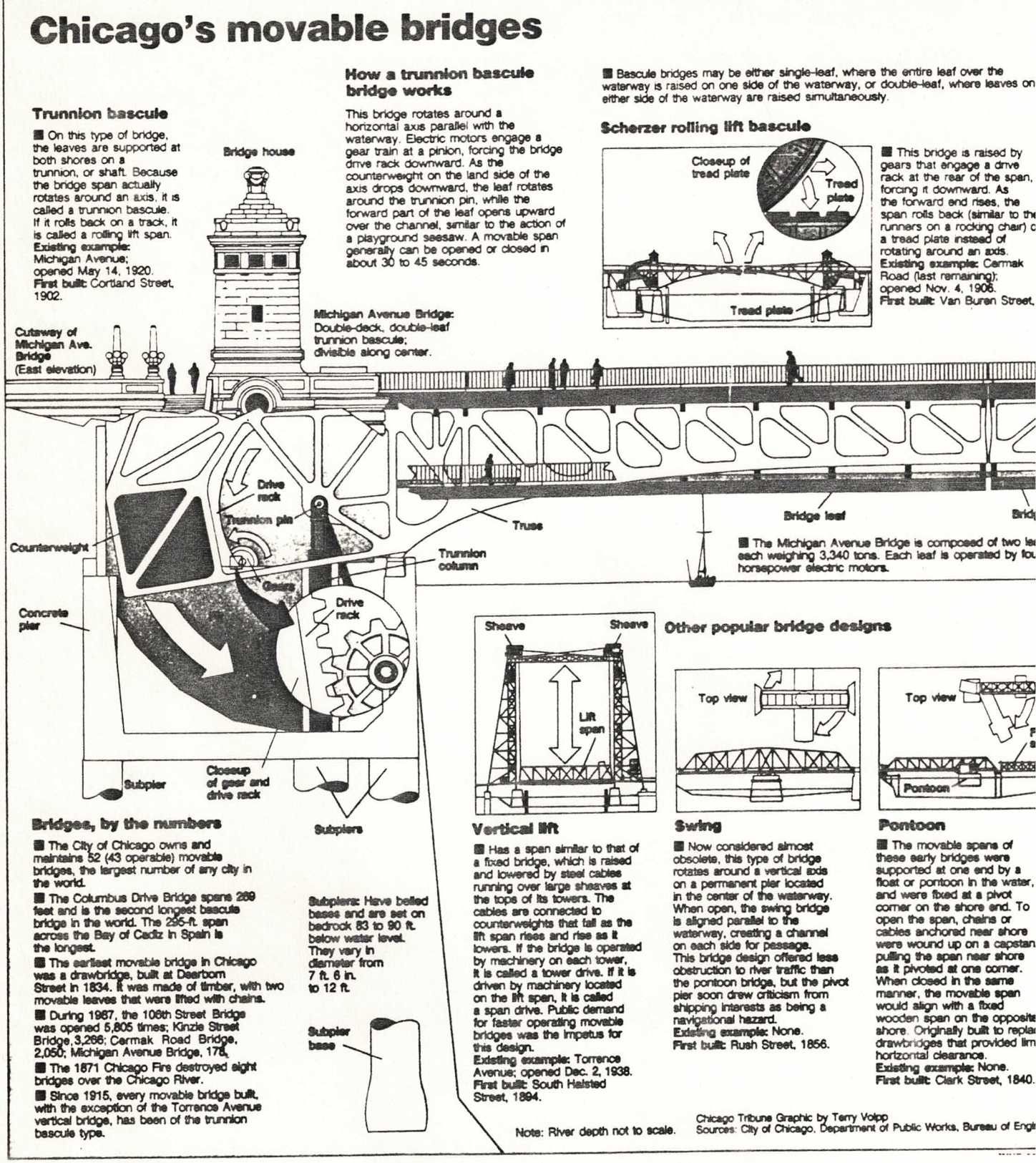
The advantages of the trunnion bascule bridge were many. Its fixed center of gravity required less massive foundations; it had a minimum of moving parts and because its leaves were nearly perfectly balanced, the bridge could be opened and closed quickly.

On May 24, 1902, Chicago's first trunnion bascule bridge was opened to traffic at Clybourn Place, now Cortland Street. This Cortland Street Drawbridge was the first of its kind completed in the United States and became a model of this type of movable bridge. So identified with the city is the trunnion bascule bridge that it is known internationally as the "Chicago style." Equally, so important was the impact of this bridge on urban transportation that the Cortland Street Drawbridge in 1982 was designated a National Historic Civil Engineering Landmark by the American Society of Civil Engineers. At the awards ceremony, John H. Wiedman, President-Elect of the society, spoke of what constitutes a civil engineering landmark. He stated that "sheer size, technical complexity, or construction quality are not sufficient in themselves to warrant a landmark designation. A facility must be unique; it must represent a significant development in the history of civil engineering." So successful was Chicago in the conception and execution of the trunnion bridge that it has become a "textbook classic" for bridge builders around the world. The Cortland Street Drawbridge has joined such illustrious company as the George Washington and Brooklyn bridges in New York City and the Eads Bridge in St. Louis as well as nineteen other bridges and viaducts across the United States as a recipient of this accolade.

Chicago's meatpackers, railroad planners, and building architects figure largely in its history and are justly credited with much of its success. Not so frequently mentioned but equally responsible for the City's ongoing progress are men of distinction in the field of civil engineering. Sometimes the names are known as in the case of Ellis Chesbrough and De Witt Crieger, creators of Chicago's water supply system in the 1860s (also recognized as a National Historic Civil Engineering Landmark). William Scherzer, due to the entrepreneurial spirit of his brother, became well-known. But, by and large, it is to the collaborative efforts of generations of persevering and visionary civil servants in the public works sector of government that Chicago owes a debt of gratitude. In 1949, the City Bridge and Viaduct Engineer Stephen J. Michuda wrote:

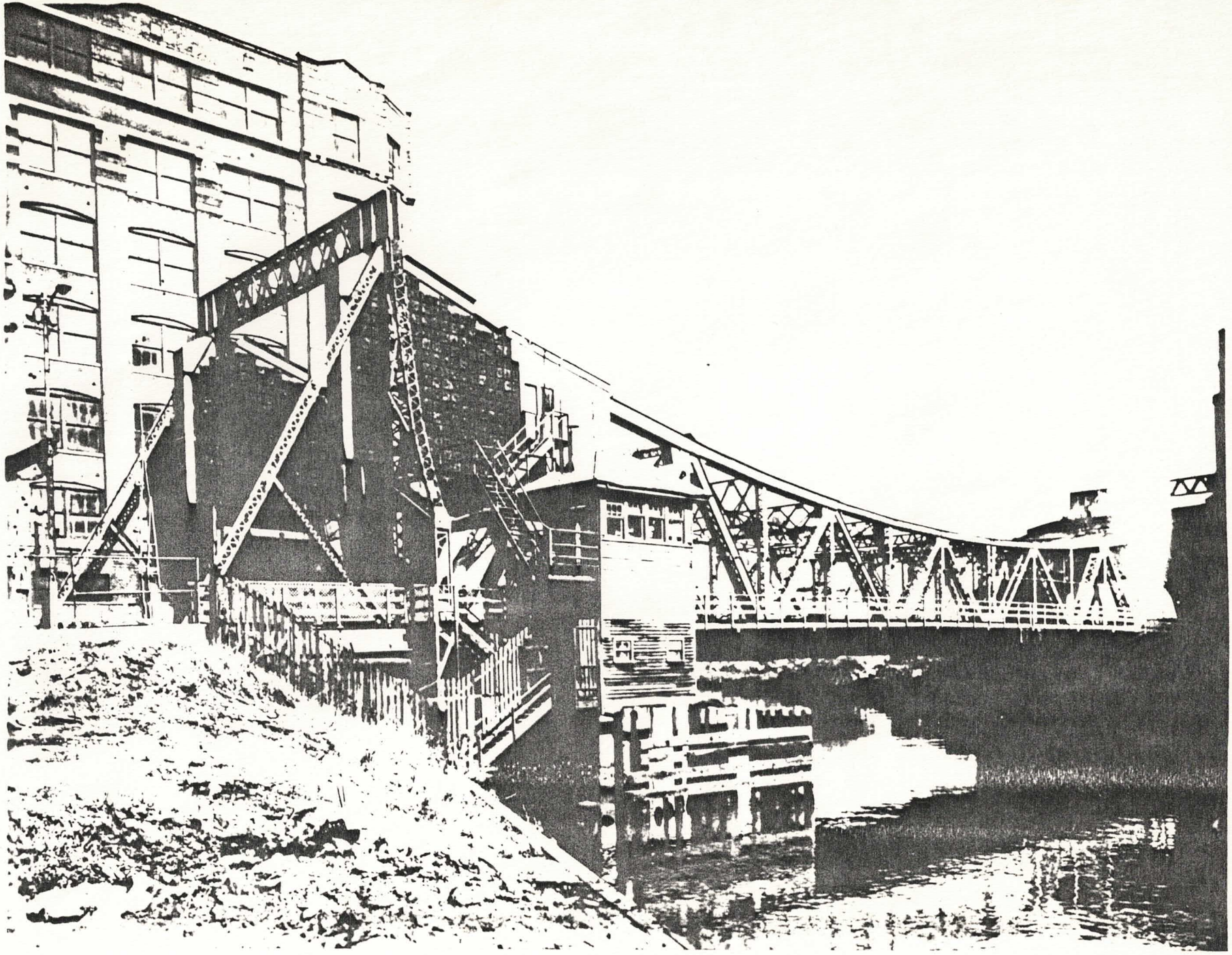
> And the bridge builder and the bridge designer have done their part toward the growth and development of this metropolis by meeting and successfully solving every problem presented either by the needs of the marine interests or the requirements of those on shore. They have developed a type of bridge that has met the requirements of the City of Chicago in every way, and the trunnion bascule bridge stands as a monument to the genius of Chicago engineers.

In the legacy of Chicago's most important civil engineering projects, the tradition of bridge building is indeed the outstanding one.

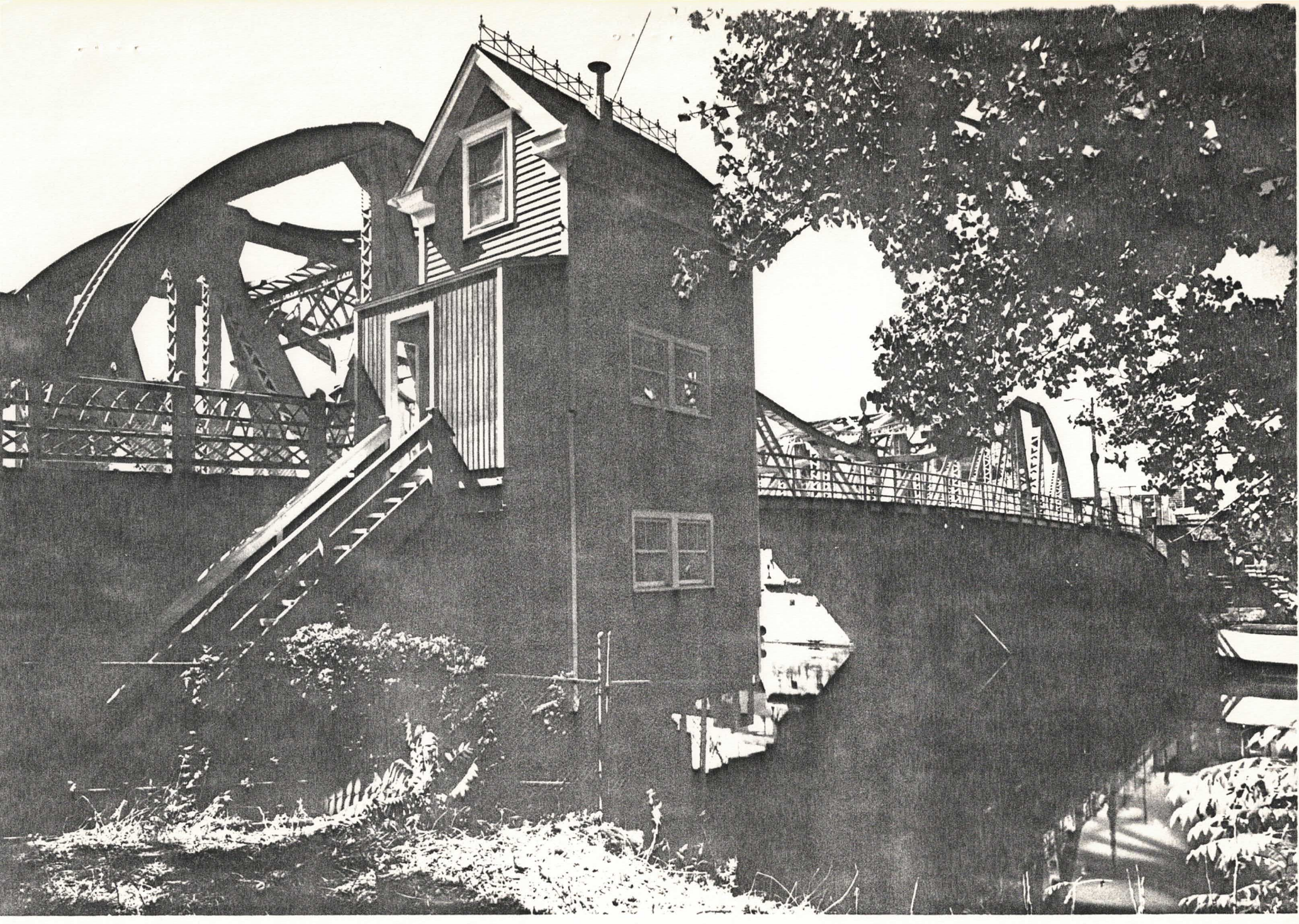

Chicago's movable bridges
Trunnion bascule
On this type of bridge, the leaves are supported at both shores on a trunnion, or shaft. Because the bridge span actually rotates around an axis, it is called a trunnion bascule. If it rolls back on a track, it is called a rolling lift span.
Existing example: Michigan Avenue; opened May 14, 1920.
First built: Cortland Street, 1902.
How a trunnion bascule bridge works
This bridge rotates around a horizontal axis parallel with the waterway. Electric motors engage a gear train at a pinion, forcing the bridge drive rack downward. As the counterweight on the land side of the axis drops downward, the leaf rotates around the trunnion pin, while the forward part of the leaf opens upward over the channel, similar to the action of a playground seesaw. A movable span generally can be opened or closed in about 30 to 45 seconds.
Bascule bridges may be either single-leaf, where the entire leaf over the waterway is raised on one side of the waterway, or double-leaf, where leaves on either side of the waterway are raised simultaneously.
Scherzer rolling lift bascule
Closeup of tread plate
Tread plate
Tread plate
This bridge is raised by gears that engage a drive rack at the rear of the span, forcing it downward. As the forward end rises, the span rolls back (similar to the runners on a rocking chair) on a tread plate instead of rotating around an axis.
Existing example: Cermak Road (last remaining); opened Nov. 4, 1906.
First built: Van Buren Street,
Bridge house
Michigan Avenue Bridge: Double-deck, double-leaf trunnion bascule; divisible along center.
Cutaway of Michigan Ave. Bridge (East elevation)
Drive rack
Trunnion pin
Truss
Bridge leaf
Counterweight
Trunnion column
Gears
Drive rack
Concrete pier
Subpier
Closeup of gear and drive rack
Subpiers
The Michigan Avenue Bridge is composed of two le each weighing 3,340 tons. Each leaf is operated by fou horsepower electric motors.
Bridges, by the numbers
The City of Chicago owns and maintains 52 (43 operable) movable bridges, the largest number of any city in the world.
The Columbus Drive Bridge spans 269 feet and is the second longest bascule bridge in the world. The 295-ft. span across the Bay of Cadiz in Spain is the longest.
The earliest movable bridge in Chicago was a drawbridge, built at Dearborn Street in 1834. It was made of timber, with two movable leaves that were lifted with chains.
During 1987, the 106th Street Bridge was opened 5,805 times; Kinzie Street Bridge, 3,266; Cermak Road Bridge, 2,050; Michigan Avenue Bridge, 178.
The 1871 Chicago Fire destroyed eight bridges over the Chicago River.
Since 1915, every movable bridge built, with the exception of the Torrence Avenue vertical bridge, has been of the trunnion bascule type.
Subpiers: Have belled bases and are set on bedrock 83 to 90 ft. below water level. They vary in diameter from 7 ft. 6 in. to 12 ft.
Subpier base
Other popular bridge designs
Sheave
Sheave
Lift span
Vertical lift
Has a span similar to that of a fixed bridge, which is raised and lowered by steel cables running over large sheaves at the tops of its towers. The cables are connected to counterweights that fall as the lift span rises and rise as it lowers. If the bridge is operated by machinery on each tower, it is called a tower drive. If it is driven by machinery located on the lift span, it is called a span drive. Public demand for faster operating movable bridges was the impetus for this design.
Existing example: Torrence Avenue; opened Dec. 2, 1938.
First built: South Halsted Street, 1894.
Top view
Swing
Now considered almost obsolete, this type of bridge rotates around a vertical axis on a permanent pier located in the center of the waterway. When open, the swing bridge is aligned parallel to the waterway, creating a channel on each side for passage. This bridge design offered less obstruction to river traffic than the pontoon bridge, but the pivot pier soon drew criticism from shipping interests as being a navigational hazard.
Existing example: None.
First built: Rush Street, 1856.
Top view
Pontoon
Pontoon
The movable spans of these early bridges were supported at one end by a float or pontoon in the water, and were fixed at a pivot corner on the shore end. To open the span, chains or cables anchored near shore were wound up on a capstan, pulling the span near shore as it pivoted at one corner. When closed in the same manner, the movable span would align with a fixed wooden span on the opposite shore. Originally built to replace drawbridges that provided limited horizontal clearance.
Existing example: None.
First built: Clark Street, 1840.
Note: River depth not to scale.
Chicago Tribune Graphic by Terry Volpp
Sources: City of Chicago, Department of Public Works, Bureau of Engi

The mechanics of the trunnion and Scherzer rolling lift bascule bridges are illustrated in this diagram which accompanied "Ups and Down" by Jeff Lyons in *Sunday: The Chicago Tribune Magazine*, June 25, 1989.

CERMAK ROAD BRIDGE in 1959



CERMAK ROAD BRIDGE in 1959



CORTLAND STREET DRAWBRIDGE in 1982.

CORTLAND STREET DRAWBRIDGE in 1982. *(Photograph by Bill Engdahl, Hedrich-Blessing)*

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Additional research material used in the preparation of this report is on file at the office of the Commission on Chicago Landmarks and is available to the public.

Staff for this publication

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The Commission on Chicago Landmarks was established in 1968 by city ordinance, and was given the responsibility of recommending to the City Council that specific landmarks be preserved and protected by law. The ordinance states that the Commission, whose nine members are appointed by the Mayor, can recommend any area, building, structure, work of art, or other object that has sufficient historical, community, or aesthetic value. Once the City Council acts on the Commission's recommendation and designates a Chicago Landmark, the ordinance provides for the preservation, protection, enhancement, rehabilitation, and perpetuation of that landmark. The Commission assists by carefully reviewing all applications for building permits pertaining to the designated Chicago Landmarks. This insures that any proposed alteration does not detract from the qualities that caused the landmark to be designated.

The Commission makes its recommendations to the City Council only after extensive study. This preliminary summary of information has been prepared by the Commission staff and was submitted to the Commission when it initiated consideration of the historical and architectural qualities of this potential landmark.

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